

THE GENUS *THEOBALDIA* (DIPTERA, CULICIDAE) IN VICTORIA.

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(Nine Text-figures.)

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Synopsis.

Three species of the genus *Theobaldia*, *T. frenchi* Edw., *T. hilli* Edw., and *T. inconspicua* Lee have been previously recorded from Victoria. To this list are now added *T. littleri* Taylor, *T. victoriensis*, n. sp., and *T. frenchi atritarsalis*, n. subsp.

The adults of *T. hilli*, *T. frenchi* and *T. littleri* are redescribed and descriptions are given of the previously unknown immature stages of these species.

On the basis of the structure of the larvae, *T. victoriensis*, n. sp., is placed in the subgenus *Culicella*. For *T. hilli* Edw. and *T. frenchi* Edw., a new subgenus, *Neotheobaldia*, and for *T. littleri* Taylor a new subgenus, *Austrotheobaldia*, are proposed.

An account is given of the biology of the Victorian species of *Theobaldia*.

INTRODUCTION.

Mosquitoes of the genus *Theobaldia* are widely distributed in the northern hemisphere mainly in temperate regions; a few species extend into the tropics in Africa and North America. In the southern hemisphere the genus is represented only by two species in Africa, one in New Zealand and seven in Australia.

The six species hitherto known from Australia are: *T. atra* Lee, from Western Australia, *T. inconspicua* Lee, from New South Wales and Victoria, *T. hilli* Edw. and *T. frenchi* Edw., from Victoria, *T. weindorferi* Edw., from Tasmania, and *T. littleri* Taylor, from Tasmania and New South Wales.

The original descriptions of these species, except the first two, were inadequate in many respects, so that accurate identification was difficult. Lee's (1937) revision went some way towards clarifying the situation, but he was hampered by having only a few specimens for examination. With an abundance of material of all the Victorian species, some collected in the field and some obtained by laboratory breeding, it has been possible to make a full analysis of their distinctive features and to prepare descriptions of the immature stages, which were previously unknown except in the case of *T. inconspicua*. This paper also includes a description of a new species, *T. victoriensis*, n. sp., and information on the biology and distribution of the genus in Victoria.

BIOLOGY.

The Australian species of *Theobaldia* are bush mosquitoes. They are present in scrub along creeks, in the bush, and are especially numerous in upland forests, where the humidity is higher and the temperature lower than in the open country. Their inability to withstand high temperature and low humidity severely restricts their distribution. Thus, while they are widely distributed in south-eastern Victoria, in the north they are practically confined to hilly and mountainous country. *T. inconspicua* is more adaptable than the other species and is found at lower altitudes and in more exposed situations.

The three species, *T. hilli*, *T. frenchi* and *T. victoriensis*, are man-biting mosquitoes and become very troublesome in late summer and autumn. During the day they fly close to the ground and confine their attacks mainly to the legs. After sunset they rise higher, biting the arms but almost never the face. *T. inconspicua* and *T. littleri* do not attack man.

This difference in feeding habits tends to give a false impression of the relative abundance of the various species. Adults of *T. inconspicua* are not common in the field, but judging from larval numbers, it is by far the most abundant form. The larvae are very numerous in rock and ground pools shaded by trees or grass.

In spite of a sustained search the larvae of the other species have rarely been seen in the field. *T. littleri* was found breeding in only one place. This was in Sherbrooke Forest, in a pool under, and largely covered by, the roots of a fallen tree. The temperature of the water, even in summer, did not rise above 13–14°C. *T. littleri* and *T. inconspicua* were breeding here during two successive years; on one occasion this pool also yielded two larvae of *T. victoriensis*. This species was also found at Ringwood, where, in company with *T. inconspicua* and *T. hilli*, it was breeding in a small, deep, semi-permanent pool shaded by long grass and trees. *T. victoriensis* and *T. hilli* larvae were found here only during the winter of 1952 and probably it is not a typical breeding place for them. It seems likely that they breed, for the most part, in the underground tunnels of the land crayfish (*Engaeus* spp.); this may also apply to *T. frenchi*, the larvae of which have not been seen in nature.

On the basis of colour and behaviour the larvae of these five species fall into two groups. Those of *T. inconspicua* and *T. littleri* are brownish and show the behaviour typical of mosquito larvae, in that, when disturbed either mechanically or by the passage of a shadow over the surface of the water, they move to the bottom of the container. In the other species the larvae are milky-white. They show no response to moving shadows and when disturbed either move just below the surface or, if originally on the bottom, move towards the surface. Their lack of pigment and their behaviour suggest that they normally live in underground water.

In *T. hilli* mating occurs during the day. Normally the males do not swarm but are seen, in small numbers, flying about in the grass close to the ground. Coupling sometimes occurs with resting females but, more usually, is initiated while both sexes are in flight and is completed on the grass. After sunset the number of "searching" males increases but they do not become numerous. However, *T. hilli* does occasionally swarm. One such swarm was observed by Mr. A. Neboiss, at 4 p.m. on May 4th, 1953. It consisted of 150–200 males flying 2–3 feet above the ground. Mating of the other species has not been observed; presumably it occurs at night.

T. inconspicua is the only one of the five Victorian species which deposits egg rafts. These have been collected in the field and can also be readily obtained in the laboratory from engorged females. I have never found the eggs of the other species in nature and for a long time failed to get oviposition in cages. Later work showed that this was a result of maintaining the mosquitoes at too high a temperature, 20–22°C. When engorged females were kept in an ice chest at 8–10°C., they oviposited regularly, 16–29 days after feeding. In the laboratory *T. hilli*, *T. frenchi* and *T. victoriensis* deposited eggs singly on moist filter paper above water level. The eggs cannot withstand desiccation; when laid on the sides of the glass vessel, instead of on filter paper, they invariably perished. After feeding on human blood the number of eggs varied from 28 to 60; an engorged female of *T. frenchi* caught in the field laid 90 eggs.

When eggs are kept in the laboratory at temperatures of 17–20°C. some eggs remain viable for a long period without hatching. Thus in one experiment only 8 out of 60 eggs had hatched after 39 days. The unhatched eggs were then kept for 24 hours at 25°C. without any more hatching; but when they were transferred to a refrigerator all the viable eggs hatched within two hours. In many cases hatching of larvae from these diapausing eggs occurred when the temperature was lowered from 17°C. to 10–11°C., but with a further fall to 2°C., hatching ceased; it was completed when the temperature was raised to 10–11°C.

In the laboratory, growth of the larvae is slow. They require clean water and at temperature of 17–19°C. take about two months to reach the fourth stage. At higher temperatures few survive.

T. inconspicua and *T. frenchi* maintain reproductive activity throughout the year; the second species was recorded as biting in July (temperature 13.5°C.) and August (temperature 8.5°C.).

T. littleri, *T. hilli* and *T. victoriensis* hibernate as larvae, mainly in the fourth stage, and the spring generation of *T. hilli* and *T. victoriensis* appears in October.